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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ROBERT LEWIS JACKSON JR.

Appeal 2016-008697
Application 13/226,299
Technology Center 2100

Before CARLA M. KRIVAK, HUNG H. BUI, and
JEFFREY A. STEPHENS, *Administrative Patent Judges*.

KRIVAK, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134(a) from a Final Rejection of claims 1–20, which are all the claims pending in the application. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

STATEMENT OF THE CASE

Appellant's invention is directed to "[s]ystems and methods for use in representing a path in a graph of nodes" as an "abbreviated path [that] excludes one or more . . . primary edges," which "collectively reach all nodes within the graph" (Spec. ¶ 2; Abstract).

Independent claim 1, reproduced below, is exemplary of the subject matter on appeal.

> 1. A method for representing all the edges in an original path in a graph of nodes as an abbreviated path, the method comprising a computing device:
>
> determining an acyclical collection of edges that collectively reach all nodes within the graph, wherein the edges in the acyclical collection are defined as primary edges, and all edges in the graph other than primary edges are defined as secondary edges;
>
> identifying an original path between a first node of the graph and a second node of the graph, wherein the original path includes one or more primary edges and one or more secondary edges; and
>
> representing the original path as an abbreviated path, said abbreviated path including the first node, the second node, and all the secondary edges from the original path, but excluding one or more of the primary edges from the original path.

REFERENCES and REJECTIONS

(1) The Examiner rejected claims 1, 2, 8, 10, and 16 under 35 U.S.C. § 103(a) based upon the teachings of Demers (US 6,105,018; issued Aug. 15, 2000) and Johnson (US 8,392,467 B1; issued Mar. 5, 2013).

(2) The Examiner rejected claims 3, 7, 9, 11, 15, 17, and 18 under 35 U.S.C. § 103(a) based upon the teachings of Demers, Johnson, and Hao (US 6,377,287 B1; issued Apr. 23, 2002).

(3) The Examiner rejected claims 4–6, 12–14, 19, and 20 under 35 U.S.C. § 103(a) based upon the teachings of Demers, Johnson, Hao, and Li (US 6,772,180 B1; issued Aug. 3, 2004).

ANALYSIS

Claims 1, 2, 8, 10, 16, and 18

With respect to claim 1, Appellant contends the Examiner erred in finding Demers discloses "determining an acyclical collection of edges" as claimed; rather, "Demers Figure 2 . . . shows many cycles (redundant edges among nodes), making his graph a cyclical graph" in contrast to Appellant's "conventional use of 'acyclical'" (App. Br. 4–5 (citing Demers col. 7, l. 33, col. 9, l. 26, Fig. 2; Spec. ¶¶ 25, 45)). Appellant also asserts Johnson does not teach or suggest the claimed "paths" because Johnson "pertains to trees, not paths" and "[t]here is a vast difference between a path and a subtree" (App. Br. 4 (citing Johnson col. 7, ll. 34–56, col. 8, ll. 4–48; Spec. ¶¶ 12, 29, 43, 51, 73–75); *see also* Reply Br. 2–3). Appellant additionally contends the Examiner's combination of Demers and Johnson does not teach or suggest the claimed abbreviated path including "all the secondary edges from the original path, but excluding one or more of the primary edges from the original path" (Reply Br. 11; *see also* App. Br. 6–7; Reply Br. 8–9, 12). Particularly, Appellant argues Johnson does not teach an original path (App. Br. 4), and Johnson's subtree and Demers' augmenting path and spanning tree do not teach or suggest an abbreviated path (App. Br. 5–6; Reply Br. 5, 11). Lastly, Appellant asserts the Examiner's rejection lacks articulated reasoning and does not acknowledge secondary considerations of the

Appellant's invention overcoming a long-felt need (App. Br. 7; Reply Br. 11). We do not agree.

We agree with and adopt the Examiner's findings as our own. Particularly, we agree with the Examiner Demers' acyclic graph "read[s] upon the claimed feature of 'an acyclical collection of edges'" (Ans. 3). Demers' "term 'acyclic' means that the edges do not form loops in the graph," thus, "directed edges would eventually terminate in a node having no edge emanating therefrom" (*see* Demers col. 7, ll. 35–40), which is commensurate with the description of "acyclical" in Appellant's Specification.[1] Appellant's argument that Demers' directed graph with "many cycles" does not teach Appellant's "undirected acyclical graph" is not commensurate with the scope of claim 1 (Reply Br. 4; App. Br. 5). Claim 1 does not recite an undirected acyclical graph, but only recites a graph including "*an acyclical collection of edges* that collectively reach all nodes within the graph." Additionally, we agree with the Examiner that (i) Demers's Figure 2 teaches the claimed *graph*, and (ii) Demers' *acyclical spanning tree* teaches the claimed "acyclical collection of edges that collectively reach all nodes within the graph . . . defined as primary edges" (Ans. 3–4; Final Act. 3 (citing Demers col. 9, ll. 12–28)).

We also are not persuaded by Appellant's argument that Johnson's trees are unrelated to the claimed paths (App. Br. 4; Reply Br. 2–3). Johnson's tree includes nodes reached by links, which is commensurate with

[1] Appellant's Specification describes "*cycles*" are formed by "redundant edges among nodes," while "an *acyclical* collection of edges" is "a collection that includes *no redundant edges between any two nodes*" (Spec. ¶¶ 25, 45 (emphases added)).

the broad description of "path" in Appellant's Specification (Ans. 2 (citing Johnson col. 7, ll. 34–56, Figs. 7–8)).[2] Appellant's additional argument that Johnson does not teach Appellant's "'path' . . . representing traversal from a first node to a last node, wherein the first and last nodes have exactly one connecting edge, and all intermediate nodes have exactly two connecting edges" is not commensurate with the scope of claim 1, which does not specify a number of connecting edges for nodes (App. Br. 4; Reply Br. 3).

As to Appellant's arguments that Demers and Johnson do not teach or suggest representing an original path as an abbreviated path, Appellant improperly attacks the references individually where the rejection is based on a combination. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981). Particularly, Appellant argues Johnson does not identify an original path (App. Br. 4, 6). The Examiner, however, also finds Demers' Figure 2 teaches this feature (Final Act. 3–4 (citing Demers col. 9, ll. 12–28, Fig 2)). We agree with the Examiner's finding that Demers' Figure 2 includes *an original path* between a first node and a second node, the original path having edges "within a spanning tree" (*primary edges*) and "edges which are not to be used within the spanning tree" (*secondary edges*) (Ans. 4; Final Act. 3–4 (citing Demers col. 9, ll. 12–18, col. 11, ll. 54–67)).

Appellant also argues Johnson's subtree and Demers' augmenting path and spanning tree do not teach or suggest an abbreviated path including all secondary edges from an original path and excluding one or more primary edges from the original path (Reply Br. 5–6, 9; App. Br. 5–6).

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[2] Appellant's Specification explains that a "path" includes a tree's nodes and edges/links (*see* Spec. ¶¶ 30, 74)), and a tree can be "a simple path or a tree combining multiple paths" (*see* Spec. ¶ 51).

Appellant's arguments again do not address the Examiner's rejection based on the combination of references, in which the Examiner relies on (i) Demers' *augmented path* for the claimed abbreviated path "including the first node, the second node, and all the secondary edges from the original path," and (ii) Johnson's *subtree* of a binary tree for the claimed abbreviated path "excluding one or more of the primary edges from the original path" (Ans. 3).

We agree with the Examiner that Demers' *augmented path* including "the edges represented by dashed arrows [that] are in the graph but not in the [graph's] spanning tree" (i.e., secondary edges) teaches an abbreviated path including secondary edges from an original path, as claimed (Ans. 3–4; Final Act. 3–4 (citing Demers col. 9, ll. 12–18, col. 14, ll. 10–25)). Appellant merely states, "Demers' augmenting path cannot be analogized to Applicant's abbreviated path" without persuasive evidence or reasoning as to why this would be the case (App. Br. 5).

Additionally, we agree with the Examiner that Johnson's *subtree*—"includ[ing] a specific set of nodes [but] not each and every edge" in a binary tree—teaches and suggests an abbreviated path excluding one or more primary edges from an original path, as claimed (Ans. 2–3 (citing Johnson Figs. 7–8)). Appellant argues Johnson's *subtree* has child links, not *primary edges* that "on their own, by definition, span the entire graph" (Reply Br. 6; App. Br. 6). Appellant's argument is not commensurate with the scope of claim 1, which does not require the primary edges to span the graph *on their own*, but only requires the primary edges to "*collectively* reach all nodes within the graph." The Examiner's findings that Johnson's subtree's links are primary edges as claimed is correct because Johnson's

links also form an acyclical collection collectively reaching all nodes within Johnson's binary tree (*see* Johnson Fig. 7).

The Examiner has also articulated sufficient reasoning for abbreviating Demers' augmenting path to exclude one or more primary edges as taught by Johnson, for the predictable result of representing subtrees in a tree (Ans. 5, 7). We agree with the Examiner that it would have been known to a skilled artisan at the time of Appellant's invention to abbreviate Demers' augmenting path to exclude one or more primary edges. Particularly, a skilled artisan would have recognized that abbreviating Demers' augmenting path to exclude primary edges would yield the predictable result of recursively reducing the augmenting path (Ans. 3–4). Such recursive reduction is useful for "determining a minimum leaf spanning tree . . . [whose] nodes correspond to anticipated query types" (Ans. 6; Final Act. 3; *see* Demers Abstract (describing recursive adjustment of an augmenting path)).

We also are not persuaded by Appellant's argument directed to long felt need as a secondary consideration. Appellant has cited insufficient evidence of secondary considerations, which our reviewing court guides "operates as a beneficial check on hindsight." *Cheese Systems, Inc. v. Tetra Pak Cheese and Powder Sys.,* 725 F.3d 1341, 1352 (Fed. Cir. 2013). Nor has Appellant shown the claimed features are responsible for producing the specified benefits or provided additional evidence (*Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010) (a nexus must be established "between the evidence and the merits of the claimed invention." (citation and quotations omitted; emphasis omitted)); App. Br. 7; Reply Br. 10).

In light of the broad terms recited in claim 1 and the arguments presented, Appellant has failed to clearly distinguish the claimed invention over the prior art relied on by the Examiner. Thus, we are not persuaded the Examiner erred and sustain the Examiner's rejection of independent claim 1, and independent claims 8 and 16 argued for substantially the same reasons (App. Br. 8). We also sustain the Examiner's rejection of dependent claims 2, 10, and 18, argued for their dependency (App. Br. 8, 15).

Claims 3 and 11

Appellant contends Hao's "user clicks on just a single child node . . . [t]he user does not select a first node and a second node, as recited in claims 3 and 11" (Reply Br. 12 (citing Hao col. 5, ll. 7–27); *see also* App. Br. 12). Appellant also argues Hao's processor merely "performs a mapping and an unmapping operation, which is not relevant to automatically determing[sic] an original path, as 'original path' is defined in claims 1 and 8" (Reply Br. 12).

As discussed *supra* with respect to claims 1 and 8, we agree with the Examiner that the combination of Demers and Johnson teaches and suggests the original path recited claims 1 and 8. We also agree with the Examiner's finding that Hao's "user may select the child node (i.e. *select either a first or second node*)" when the user "click[s] on a child node that has a secondary path" to visualize the node's multi-paths (Ans. 8 (citing Hao col. 5, ll. 7–27) (emphasis added); Final Act. 4–5). Thus, Hao teaches and suggests receiving a selection of first and second nodes from a user, as claimed (Ans. 8).

Additionally, we agree the Examiner's combination of Hao's *automatically mapping* a secondary subtree to a selected/clicked node to

visualize the secondary subtree, with Demers' *computer system determining a minimum leaf spanning tree* for anticipated query types, teaches and suggests the automatically determining the original path based only on end nodes' selection as claimed (*see* Hao col. 5, ll. 7–27; Demers Abstract; Ans. 8). Appellant's arguments do not address these findings by the Examiner as they do not argue the combination of Demers and Hao.

Accordingly, Appellant's arguments have not persuaded us of error in the Examiner's rejection of claims 3 and 11. Therefore, we sustain the Examiner's rejection of claims 3 and 11.

Claims 4 and 12

Appellant contends Hao's "hyperbolic spaces with multi-paths . . . are not relevant to an abbreviated path as defined in parent claims 1 and 8" (App. Br. 16). However, as discussed *supra* with respect to claims 1 and 8, we agree with the Examiner that the combination of Demers and Johnson teaches and suggests the abbreviated path of claims 1 and 8.

Appellant also argues Li does not teach the claimed abbreviated path representation because Li "lists all of the nodes in the path" in contrast to Appellant's claims 4 and 12—in which "non-end nodes on primary edge paths are not included in the textual representation of the path" (App. Br. 16). Appellant's argument is not commensurate with the scope of claims 4 and 12, which do not require "non-end *nodes* on primary edge paths" to be excluded from the claimed textual representation. Rather, claims 4 and 12 only require primary *edges* to be excluded from the abbreviated path representation, by virtue of base claims 1 and 8.

We also agree the combination of Li's textual path representation, with the abbreviated path taught by Demers and Johnson teaches and

suggests creating and outputting a textual representation of the abbreviated path, as recited in claims 4 and 12 (Ans. 9; Final Act. 6–7). As Appellant's arguments have not persuaded us the Examiner erred in rejecting claims 4 and 12, we sustain the Examiner's rejection of these claims.

Claims 5, 13, and 19

Dependent claim 5 recites "outputting . . . said textual representation [of the abbreviated path] excluding at least one node from the path." Claims 13 and 19 similarly recite a "textual representation excluding at least one node from the path." The Examiner finds Demers, Johnson, and Hao's teaching of selecting specific nodes and paths with Li's teaching of a "path table in the form of a textual representation" suggest "only selected endpoint nodes may be provided in a textual representation" (Ans. 9–10).

Appellant argues although Hao's mapping/unmapping moves nodes in a tree, "Hao displays all nodes in the graph in every state," thus, the "number of nodes remains consistently n" (App. Br. 11). Similarly, "Li lists all of the nodes in the path," and therefore "Li outputs every node, not 'only those nodes that are endpoint nodes of each secondary edge in the abbreviated path'" as claimed (App. Br. 16–17; *see also* Reply Br. 15). We agree with Appellant neither Hao nor Li teaches a textual path representation *excluding at least one path node*; rather, Li and Hao display all the path's nodes (*see* Li Fig. 5; Hao Abstract). The Examiner also has not shown that Demers and Johnson output a path's representation excluding at least one node from that path.

As the Examiner has not identified sufficient evidence to support the rejection of claims 5, 13, and 19, we do not sustain the Examiner's rejection of claims 5, 13, and 19. Because we reverse the Examiner's rejection of

claims 5 and 13, we also reverse the rejection of claims 6 and 14, dependent therefrom.

Claims 7 and 15

Dependent claim 7 recites "reconstructing the original path from the abbreviated path based on the derived primary edges." Claim 15 similarly recites the "reconstructing" limitation using commensurate language. The Examiner finds Hao identifies multi-path nodes with hidden secondary connections that can be mapped or unmapped, suggesting "to one of ordinary skill in the art that an original path may be derived from the abbreviated path based on the derived primary edges" (Ans. 9 (citing Hao col. 5, ll. 46–61); *see also* Final Act. 5–6 (citing Hao col. 3, ll. 11–28, col. 6, ll. 30–40; Fig. 10).

Appellant argues Hao's mapping and unmapping merely "determin[e] whether a selected [multi-path] node has 'secondary paths' (i.e., hidden outgoing edges) emanating from it" and "show[] [the] 'secondary paths' from [the] selected node" (App. Br. 13–14); however, "Hao *doesn't reconstruct anything* in his mapping/unmapping operation[, but] simply moves a sub-tree" from a root node's primary path to a different, secondary path at a multi-path node (Reply Br. 14 (emphasis added)). We agree with Appellant. The cited portions of Hao do not reconstruct a primary/original path from an abbreviation of that path, as required by claims 7 and 15 (App. Br. 14–15 (citing Hao Fig. 10)). As the Examiner has not identified sufficient evidence to support the rejection of claims 7 and 15, we do not sustain the Examiner's rejection of claims 7 and 15.

Claims 9 and 17

The Examiner finds Hao's Figures 6, 10, and 11 teach and suggest depicting primary edges from an original path as a single primary edge (Final Act. 5–6 (citing Hao col. 6, ll. 30–40; Figs. 6, 10–11)).

Appellant contends Hao does not teach or suggest depicting multiple edges as a single edge, as required by claims 9 and 17; rather, Hao's graphical representation merely distinguishes between multi-path nodes and other graph nodes, and "hide[s] edges (for example, 'secondary paths' in the 'idle state')" (App. Br. 14–15). We agree with Appellant. We have reviewed the cited portions of Hao and do not find support for the Examiner's findings. In particular, Hao's Figures 6, 10, and 11 merely move subtrees from a root node's primary path to a multi-path node's secondary path, but do not depict multiple edges as a single edge, as claimed. The Examiner's Answer does not respond to Appellant's arguments.

As the Examiner has not identified sufficient evidence to support the rejection of claims 9 and 17, we do not sustain the Examiner's rejection of claims 9 and 17.

Claim 20

The Examiner finds Li's path table including a path of "q.r.s.v.w" for a data element suggests "[Hao's] multi-path nodes may be represented in the form of a character string separated by the delimiting character" as required by the claim (Ans. 10; Final Act. 7–8 (citing Li col. 5, ll. 32–58; Figs. 5, 12)).

Appellant argues Li's path table "delimits every node of the path" in contrast to claim 20 which recites "delimiters between just those nodes that

are endpoint nodes of each secondary edge in the abbreviated path" (App. Br. 16–17). We agree with Appellant Li does not teach a textual representation with delimiters *just* between endpoint nodes of *secondary edges*. Rather, Li's textual representation displays delimiters between *all the path's nodes*, including endpoint nodes of *primary edges* (*see* Li Fig. 5, primary edge endpoint node "q" is delimited in "q.r.s.v.w"). The cited portions of Hao, Demers, and Johnson do not disclose delimiters in textual representations, and therefore do not make up for the above-noted deficiencies of Li. As the Examiner has not identified sufficient evidence to support the rejection of claim 20, we do not sustain the Examiner's rejection of claim 20.

OTHER ISSUES

In the event of any further prosecution of this application, the Examiner may wish to consider rejecting claims 1, 8 and 16 under 35 U.S.C. § 101 as directed to non-statutory subject matter, i.e., an abstract idea in light of the Supreme Court decision in *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S.Ct. 2347 (2014).

In *Alice*, the Supreme Court sets forth an analytical "framework for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts." *Id.* at 2355 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S.Ct. 1289, 1296–97 (2012)). The first step in the analysis is to "determine whether the claims at issue are directed to one of those patent-ineligible concepts." *Id.* For example, abstract ideas include, but are not limited to, fundamental economic practices, methods of organizing

human activities, an idea of itself, and mathematical formulas or relationships. *Id.* at 2355–57.

If the claims are directed to a patent-ineligible concept, the second step in the analysis is to consider the elements of the claims "individually and 'as an ordered combination'" to determine whether there are additional elements that "'transform the nature of the claim' into a patent-eligible application." *Id.* (quoting *Mayo*, 132 S.Ct. at 1297–98). In other words, the second step is to "search for an 'inventive concept'—*i.e.*, an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'" *Id.* (brackets in original) (quoting *Mayo*, 132 S.Ct. at 1294). The prohibition against patenting an abstract idea "'cannot be circumvented by attempting to limit the use of the formula to a particular technological environment' or adding 'insignificant postsolution activity.'" *Bilski v. Kappos*, 561 U.S. 593, 610–11 (2010). A claim reciting an abstract idea also does not become eligible "merely by adding the words 'apply it.'" *Bancorp Servs., LLC v. Sun Life Assurance Co. of Can. (U.S.)*, 687 F.3d 1266, 1276 (Fed. Cir. 2012).

In the first step of the framework set out in *Alice*, the Examiner may wish to consider whether Appellant's claims 1, 8, and 16 are directed to a patent-ineligible concept, such as an abstract concept of mathematically manipulating data to modify characteristics of the data and generate additional data. All the steps of Appellant's claim 1, including, for example: i) determining an acyclical collection of edges that collectively reach all nodes within a graph; ii) identifying an original path; and iii) representing the original path as an abbreviated path, are abstract mathematical concepts

and algorithms that could be performed in the human mind, or by a human using a pen and paper, without need of any computer or other machine. *See CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1372–73 (Fed. Cir. 2011) ("[A] method that can be performed by human thought alone is merely an abstract idea and is not patent-eligible under § 101."); *see also In re Comiskey*, 554 F.3d 967, 979 (Fed. Cir. 2009) ("[M]ental processes–or processes of human thinking–standing alone are not patentable even if they have practical application."); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) ("Phenomena of nature . . . , *mental processes*, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work" (emphasis added)). Additionally, mental processes remain unpatentable even when automated to reduce the burden on the user of what once could have been done with pen and paper. *CyberSource*, 654 F.3d at 1375 ("That purely mental processes can be unpatentable, even when performed by a computer, was precisely the holding of the Supreme Court in *Gottschalk v. Benson*.").

Furthermore, data analysis and algorithms are abstract ideas. *See, e.g.*, *Alice* 134 S.Ct. at 2355; *Parker v. Flook*, 437 U.S. 584, 589, 594–95 (1978) ("Reasoning that an algorithm, or mathematical formula, is like a law of nature, *Benson* applied the established rule that a law of nature cannot be the subject of a patent."); *Benson*, 409 U.S. at 71–72. That is, "[w]ithout additional limitations, a process that employs mathematical algorithms to manipulate existing information to generate additional information is not patent eligible." *Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344, 1350–51 (Fed. Cir. 2014) ("Data in its ethereal, non-physical

form is simply information that does not fall under any of the categories of eligible subject matter under section 101.").

In the second step of the framework set out in *Alice*, the Examiner may wish to consider whether Appellant's claims 1, 8, and 16 recite any "inventive concept" or "an element or combination of elements" that amounts to significantly more than the recited abstract concept. *See Alice*, 134 S.Ct. at 2357 ("[W]e must examine the elements of the claim to determine whether it contains an 'inventive concept' sufficient to 'transform' the claimed abstract idea into a patent-eligible application. A claim that recites an abstract idea must include 'additional features' to ensure 'that the [claim] is more than a drafting effort designed to monopolize the [abstract idea]'" (citations omitted)).

We leave it to the Examiner to determine if Appellant's independent claims 1, 8, and 16 are directed to no more than a patent-ineligible abstract idea under 35 U.S.C. § 101, and claims 2–7, 9–15, and 17–20, dependent therefrom.

DECISION

The Examiner's decision rejecting claims 1–4, 8, 10–12, 16, and 18 is affirmed.

The Examiner's decision rejecting claims 5–7, 9, 13–15, 17, 19, and 20 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART